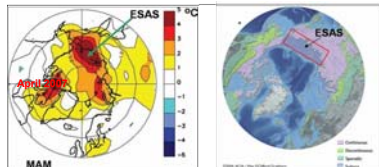


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Motivation:

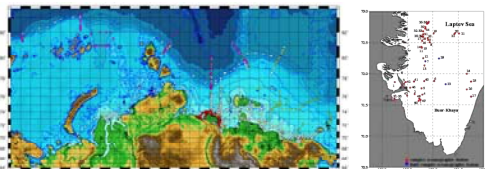


- Arctic Ocean is small (~4% from total World Ocean), but it is unique because one is surrounded with onshore and underlain with offshore permafrost which contains a huge reservoir of organic matter and trapped methane, including methane in form of gas hydrates (about 6,000Gt);
- Area of subsea and land permafrost (near 14 mln sq.km) is equal to the total area of Arctic Ocean;
- Arctic shelf is the broadest and shallowest shelf (yet least explored) in the World Ocean and is the most strongly impacted by warming (enhanced fresh water and heating impact from river plumes, sea ice retreat, coastal and bottom erosion).
- East Siberian Arctic Shelf (ESAS) is most impacted by warming.
- ESAS exhibits > 90% of the sub sea permafrost which is now in transition phase

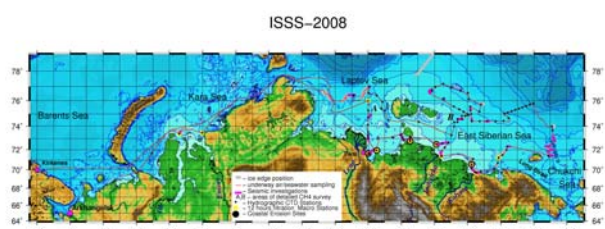
Goals:

- 1) elucidate the role of the ESAS in the regional carbon cycle.
- 2) identify the main processes driving the carbon cycle on the ESAS;
- 3) evaluate the response of Arctic marine ecosystems to ongoing climate change.

Field studies: 1999-2009

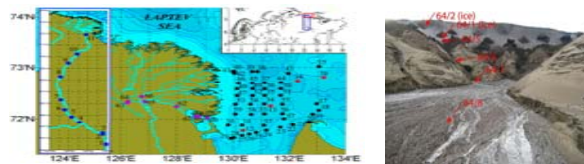


During the 1999-2009, 17 cruises and 2 winter expeditions on the sea ice were conducted, ~1300 oceanographic stations were performed. Left: main cruises 2003-2009; right: First Russia- US IPY expedition (March-April 2007)



A complex program was accomplished during the 50-days ISSS-08 cruise August – September 2008 using three vessels by participants from 12 organizations in Russia, Sweden, USA and UK.

The main vessel H/V *Yacob Smirnitziy* traveled the entire length of the Siberian coast from Kirkenes, Norway to Herald Canyon, Chukchi Sea and back along the outer shelf.

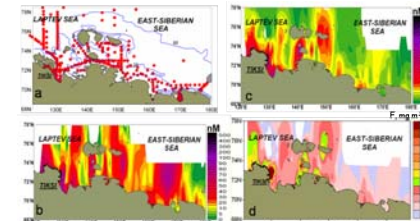


A second ship (*Neptun*) sampled the Lena River, and its delta channels and third (*TB-0012*)- the southeastern shallow Laptev Sea visiting eroded coastal ice-complexes



Main ISSS-08 initial results

The current atmospheric methane emission from the East Siberian Arctic Shelf of ~8Tg/yr is on par with previous estimates of methane venting from the entire World Ocean.



Summertime observations of dissolved methane in the East Siberian Arctic shelf: (a) positions of oceanographic stations in the eastern Laptev Sea and East Siberian Sea; (b) dissolved methane in bottom water; (c) dissolved methane in surface water; (d) fluxes of methane venting to the atmosphere over the ESAS (Shakhova, Semiletov et al., Science, 327, 2010, 1246-1250)

Evidence of ebullition: water column (2007 & 2009) and sea ice, the Laptev Sea

